

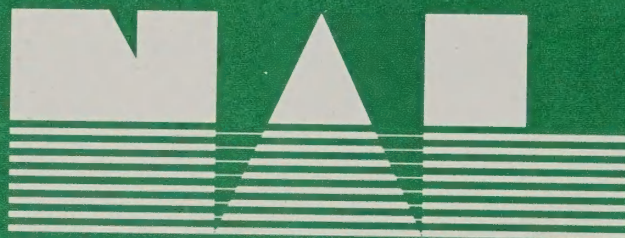
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SOME HYPOTHESES AND TENTATIVE CONCLUSIONS  
REGARDING THE CONSUMPTION IMPACTS OF  
RURAL INFRASTRUCTURE PROJECTS IN  
GUATEMALA

by

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## FOREWORD

The Nutrition Economics Group was created in 1977 with funding from AID's Office of Nutrition. The Group's staff of economists help AID implement a program of applied research and technical assistance designed to assist developing countries integrate food consumption and nutrition concerns into their agricultural planning, programming and policy making processes. Located within the Technical Assistance Division of the Office of International Cooperation and Development within the Department of Agriculture, the Group can draw on a wide variety of other specialists from within the Department as well as the U.S. land grant university system to complement its work.

The Group is also concerned with AID agricultural projects and how to improve their consumption/nutrition impacts through better design, implementation and evaluation. In line with this objective, the Group has provided technical assistance to project design efforts in Burma, Guatemala, Indonesia and Panama.

In this case, an economist in the Group assisted with an evaluation of a small farmer development project funded by USAID/ Guatemala. The USAID was interested in having Smith evaluate the impact of the project on cropping patterns, production technology and farm incomes. We and the Office of Nutrition were interested in having him look further into the uses of any increased income and to explore whether changes in cropping patterns and increases in incomes had affected the food consumption of the farm families involved in the project. Smith was already knowledgeable about the project and project area, having served in Guatemala for USDA/AID for several years prior to joining the Group. This undoubtedly made it easier for him to respond as successfully as he did to these multiple objectives given the limited time he had in country and the fact that he had little or no base line data against which to make comparisons.

Smith's major findings were presented to the USAID in a separate report. The purpose of this paper is to highlight the consumption/nutrition dimension of his assignment -- what he was able to find out about the likely consumption/nutrition impacts of the project, how he went about this aspect of his assignment, and what should be done to further substantiate his hypotheses.

Smith's experience demonstrates that much can be learned about the likely food consumption effects of an agricultural project within the normal time frame of a project evaluation if one makes the effort to ask a few additional, relatively simple questions. Smith's experience also suggests several reasons why project designers and evaluators should be concerned about these effects -- (1) the project clientele, the farmers, are, and (2) the relationship between increased income and improved food consumption patterns may not be as simple or direct as many have assumed.

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May 1984





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ABSTRACT

During a hurried evaluation of the effects of several infrastructure development projects for small farmers in the Guatemalan Highlands, the author had an opportunity to inquire into what some of the farmers were doing with net monetary gains flowing from increased production. In some cases it was possible to relate these gains to food expenditure. Time and resources required for a statistically rigorous survey into changed dietary practices were not available, but it proved possible to make some tentative generalizations suitable for further testing in the future.

Farms continuing to raise traditional grain crops on newly terraced lands or lands under simple irrigation systems experienced significant increases in output, enough to overcome prior deficit in annual production. Eating patterns seem unchanged, but the source of food has been largely "internalized" on farms. Farms continuing to raise vegetables and other nontraditional crops on newly terraced lands experienced increases in yields and cash incomes of approximately 30 percent; there is some evidence that their diets, already more varied than those of their traditional counterparts, have gained in volume. Presumably nutrient intake has improved, although how much is unknown.

The largest gains in cash incomes were enjoyed by farmers combining terracing, simple irrigation, and new crops. Net income gains of 600 percent to 1000 percent in the first two years were reported. However, when asked, many of these farmers indicated their income gains are being spent on non-food items such as farm improvements and hired labor and other inputs. This may be the result of a "permanent income" effect, that is, a lag between present income and what farmers perceive to be their likely permanent income in the future. As the latter rises, food expenditures may change.





## BACKGROUND

During the month of May 1983, I undertook an economic evaluation of three components of a small farmer development project funded by USAID/Guatemala during the years 1977-1983. Each component of the project was originally designed as a pilot activity which, if implementation were successful, would be extended and expanded as follow-on projects. The components I was asked to evaluate were (1) rural access roads (construction and maintenance), (2) soil conservation (mainly hillside terracing), and (3) small-scale irrigation (gravity flow/sprinkler and electric pump/sprinkler systems).

The focus of the evaluation was altered cropping patterns, production techniques, and farm incomes rather than consumption or nutrition per se. Moreover, time constraints limited the amount and precision of information I was able to obtain in any one location. Nevertheless, I was able to ask some general questions about food consumption and altered uses of incomes in most places I visited. The replies, while not highly detailed, were intriguing and suggest several hypotheses which could be tested via more conventional household consumption/expenditure surveys. The purpose of this paper is to discuss these hypotheses and to speculate on their implications for the mutual interaction between production and consumption of food on small farms in countries like Guatemala.

## THE PROJECT AND ITS COMPONENTS

Activities under the USAID/Guatemala Small Farmer Development Project were concentrated in two of Guatemala's eight development regions: Region 1, comprising the Western Highlands area to the Mexican border,



and Region V, comprising the Central Highlands, including the capital city. Region I, presently the primary focus for government-sponsored development efforts, contains the poorest agricultural areas in the country, the highest proportion of ethnic Indian population, and the most severe political instability. Region V also contains a large proportion of Indians but fewer remote areas, more cooperatives and other rural aggregations, and, because of the nearness of Guatemala City, more commercial activity, industry, and tourism. To a significant extent, these differences between the two regions are paralleled by differences in farmers' responses to the project and its components. Regional differences in project implementation are summarized here; differences in consumption responses are discussed in the following sections.

In both regions, the rural access roads project resulted in construction of numerous two to ten kilometer stretches of "all-weather" unpaved roads linking small communities to larger ones via hitherto non-existing or very poor connections to existing primary and secondary roads. Where transport costs were not the main constraints to local farm incomes, new or improved roads seem to benefit non-farmers more than farmers--roadside businesses, truckers, bus operators, local handicraft producers and the like. This is the situation in Region V, where relatively poor or exhausted soils limit the amount of produce farmers can afford to market after meeting their own families' food needs. In Region I, however, the soil is better and the terrain rougher; there, roads have significantly improved farmers' access to markets, transport operators' access to farmers, and everyone's access to such public services as schools and health clinics. Even where roads made a difference for farmers, however,





the effect on farm incomes has been relatively small where road penetration has not coincided with complementary activities such as soil conservation, irrigation, and/or crop diversification.

Soil Conservation refers mainly to hillside terracing in rural Guatemala. The objective is to prevent erosion, retain water, prevent runoff of fertilizers and pesticides, and, because of all this, permit denser planting and resultant higher yields.

Terracing has been well received in both Regions I and V, and the momentum of terracing continues. In parts of both regions, some farmers, having terraced their lands, continue to raise traditional staple crops such as corn, beans, squash; these farmers have enjoyed substantial increases in yields (up to 100 percent in many cases), but relatively small gains in incomes. Farmers having previously diversified into fruits and vegetables prior to terracing have found yields of most crops increased from 40 to 60 percent on terraces; since these crops are mainly grown for cash, income gains have been commensurate. Commercially-oriented farmers adopting terracing predominate in Region V, but their numbers in Region I are growing.

Small scale irrigation techniques are more sharply distinguished by region. The majority of gravity flow systems are found in Region I, where the higher mountains and more rugged terrain contain numerous year-round springs. Such systems are cheap to install and maintain. In Region V, resort has been made to electric pumping systems in many cases where the only nearby source of water is a river or stream flowing in a bed cut 50 to 100 meters below the level of the participating farms. Due to the



expense of installation and maintenance, such systems tend to be used by farm cooperatives and communities where resources can be pooled to grow lucrative commercial crops such as strawberries, flowers, and Chinese pea pods. Despite high costs, net gains in incomes have been large, not only due to increased yields, but because of the greater number of harvests which can be obtained in one year.

The most impressive income gains have occurred on farms where two or more innovations have been adopted simultaneously. The most common instances have been combining terracing with irrigation, terracing with diversification of crops, or all three. Sustained gains of 500 to 600 percent cash earnings per unit area have been reported, predominantly in Region I where incomes were low to start with and where rough terrain combined with many springs has favored irrigated terraces. The new crops--mainly radishes, carrots, potatoes, lettuce, cabbages, onions, and garlic--have found ready markets in a region where there was a pre-existing network of vegetable storage and transport facilities.

#### CONSUMPTION EFFECTS

In general, it was clear that all three kinds of subprojects have had positive impacts upon incomes, especially of farmers having adopted terracing and irrigation. As mentioned above, my task was to establish this fact and to document it to the best of my ability, given severe time constraints. Unfortunately, no baseline studies or interim evaluations had been conducted for these activities, and I had nothing to compare my results with, save the farmers' own statements about how "things have





changed." My questions necessarily were few and followed an open format. This was especially true in the case of questions involving uses of income. In most instances, I merely opened by asking the farmer "What have you done with our extra income?" or, alternatively, "What do you do with your extra (corn, beans, vegetables, ...etc)?" Whatever it was, I would record the answer and then, if the answer seemed interesting, I might follow up with an additional questions or two. There was no attempt to follow a systematic pattern of questioning about consumption with all respondents because of time limitations and the need to focus on supply-oriented questions. Nevertheless, as indicated earlier, the answers I did get strongly suggest the desirability of followup surveys of household expenditures and, equally important, of intrahousehold changes in family roles, labor patterns, and food allocation. Impacts of innovation upon farmers' patterns of food consumption seem to depend on at least three things: (1) whether or not farmers diversify their crops following the innovation, (2) the specific kind of irrigation technology adopted and whether or not irrigation is combined with terracing, and (3) what happens to farmers' cash incomes and their perceptions of it. These are discussed in that order.

### Crop Diversification

Both terracing and irrigation have two kinds of effects upon farm consumption which, for want of better terms, I call the "farm effect" and the "market effect." The "farm effect" refers to changes in food consumption patterns brought about by changes in home production and relative levels of family consumption out of home production. "Market



effect" refers to changes mainly in food expenditures arising from changes in family incomes and in food prices. Both effects could operate together in instances where significant diversification of crops takes place on a given farm; as farms become more commercialized, the market effect will likely gain relative to the farm effect in governing patterns of families' food choices and the ultimate sources of foods consumed.

In many terracing sites and some mini-irrigation areas, especially those in the Central Highlands and in the vicinity of Patzun and Lake Atitlan, farmers continue to raise traditional milpa crops, that is, mainly corn and beans. Nevertheless, these farms generally report a doubling of their annual output of these crops. On terraced fields, milpa can be planted more densely, fertilizers and pesticides remain in place, and water can be managed better. On gravity-irrigated fields, yields per harvest increase somewhat, in the absence of any other innovation, but two crops rather than one are possible with the extra water. Has there been any change in consumption patterns on such farms?

Before terracing or irrigating, farmers report, their families had raised corn and beans mainly for home consumption, generating small cash incomes from activities such as sale of firewood, artisan activities, and--a long tradition--annual migration for work on coastal plantations. Since pre-project yields, according to the farmers I spoke with, were insufficient to support families' consumption of corn and beans during a full year, purchases of these were usually necessary prior to the next harvest. With the advent of terracing and irrigation, participating





farms can now produce enough to feed themselves during the entire year from their own production with, perhaps, a small marketable surplus. Consequently, their market expenditures have fallen: the strength of the "farm effect" of the innovations has led to a reduced reliance upon local food markets for these households. Total consumption and dietary patterns have not changed much, but the sources of foods have, and the farmers seem to feel better off.

It should be noted here that in some areas of the country, small food stores dot the countryside near small villages and larger towns. Farmers often buy odds and ends in these stores, including some food items, fruit drinks, soda pop, and liquor. Thus, actual food expenditures may not have declined as much as it seems, and I do not doubt that the quantities of "store bought" foods will rise in the future following increases in net cash incomes. Some of the "non-diversifying" farmers I spoke with said they were experimentng gingerly with some non-traditional crops--squash, melons, carrots, potatoes, for example--for sale in local markets. None indicated they expected their families to consume much of these, however. In other words, it is likely that the market effect will gain in strength apace with gains in sales to, and earnings from, markets in the affected areas.

The market effect already has strengthened where (1) farms previously growing nontraditional crops continue to do so following terracing/irrigation, and (2) farmers have experimented more extensively with cash crops, for example, in and around Guatemala City. On such farms, overall



yields of vegetable crops have increased roughly 30 percent or more with terracing alone, and there have been corresponding gains in cash incomes. There is some evidence that farmers in this group are consuming more home-grown vegetables than before, thus splitting the difference between home consumption and increased cash from sales; for the most part, these are farmers who had diversified before terracing/irrigation. Others who have diversified following terracing/irrigation seem to be selling a higher proportion of their new crops, that is, they are not as "used to" consuming nontraditional vegetables as farmers having diversified earlier. The former, when asked what they were doing with their augmented cash incomes, usually replied that they were (1) reinvesting in seed, fertilizer, pesticides, and/ or (2) buying utensils and clothing, and/or (3) travelling to the Capital and visiting friends and relatives more often. None indicated that they were buying more food.

### Irrigation Technology

Irrigation projects, whatever their scale, have two effects upon output: greater yields, due to better control of water in conjunction with other inputs, and more harvests per year, due to extended availability of water, even during normally dry seasons. Both of these effects have been observed on farms participating in the mini-irrigation project in Guatemala. Where irrigation has been combined with terracing and/or crop diversification, the results have been amplified, sometimes spectacularly.



The advantage of gravity flow system is simplicity, ease of installation, and very low maintenance costs. The advantage of electric pump systems is the greater potential water flow and consequent servicing of larger numbers of farms, albeit at sometimes high costs in maintenance and electrical energy.

Pump irrigation is almost exclusively associated with commercial farming by participants (mainly in Region V, the Capital area) due to the high operating costs which are more easily offset by the scale economies of group farming techniques on consolidated farms. Small farmers employing such systems "clump together" whether in formal cooperatives or informal village aggregations, in order to share expenses and maintain a high volume of output. Farm communities in Region V have focused on crops with sustained high market value, such as flowers, strawberries and other fruits, and Chinese "snow-peas" for export.

In other parts of Region V and in Region I, gravity-flow farmers can be found having significantly altered their cropping patterns by diversifying into many vegetable, root, and tuber crops. Some of these have enjoyed nearly incredible increases in short-run net incomes, especially those having terraced as well as irrigated. In the Departments of San Marcos and Quezaltenango, some farmers I visited report an initial ten-fold gain in net cash incomes following the first year of irrigation and diversification. With as many as ten crops to choose from, as many as four harvests per year for individual crops, and greater flexibility in choosing sowing and harvest times, these farmers have been able to





exploit changes in local prices effectively. With more complete market information from other parts of the country, they might do even better.

It should be noted, however, that the San Marcos Quezaltenango axis is a strong market for vegetables and that the scale of the irrigation projects has been small so far. Some prices have already begun a downward drift as supplies have grown, and this can be expected to intensify as more farmers and more regions adopt irrigation and new cropping systems. Attention to improving marketing outlets and information will become critical in the near future if per-household incomes are not to decline in the longer run.

Both "gravity-flow" innovators and "pumping systems" innovators have seen large increases in their cash earnings per unit land. The impact upon food expenditure and consumption patterns seems to have been somewhat different as between the two cases, however. Gravity-flow innovators generally have smaller farms, and while they tend to band together as communities and/or cooperatives, such groupings are looser and more individualistic than those among the pumping systems innovators. Consequently, gravity-flow innovators often abandon traditional crops altogether in order to maximize earnings from new crops on their limited land areas. Such farmers now buy corn and beans. Pumping systems farmers, on the other hand, often continue to grow milpa alongside their extensive commercial crops, although in a more systematic way than before, with previously separated fields consolidated. Since the milpa also benefits from irrigation, these farmers can market a surplus, at least of



corn. Sales usually wind up in the urban areas, but one can see a possible complementarity between what these farmers are doing and the need among the gravity-flow farmers to purchase corn and beans.

#### Uses of Cash Incomes

It was intriguing to discover that both groups of irrigating farmers failed to report significant changes in food purchases with new cash incomes. Most say that they use their new cash (1) to make improvements to their homes and farm implements, (2) to buy seed, fertilizer, and pesticides to experiment with new crops, (3) to pay for hired labor to permit an older son or two to go to school, and other such individual, "lumpy" expenditure items. I suspect that not a little cash finds its way into local stores for odds and ends and for alcohol, but nobody mentioned these things during my hurried interviews.

What we may be seeing here is a Third World equivalent of the old permanent income hypothesis: people with sudden gains or losses of income resist changing spending patterns until several income cycles have passed. Income gains--regarded as probably transient--are used to pay for previously deferred individual purchases. Food expenditures are geared to food preferences, among other things, and preferences take some time to change overall, despite high income elasticities of demand for individual items. In short, changes in consumption lag changes in income until the latter come to be seen as "permanent."

A key hypothesis for future testing is that, if income gains can be preserved, and if farm households continue to raise a variety of foods, diets will diversify and market purchases of foods not produced at home will increase.



### SUMMARY

On the basis of fragmentary, hurriedly acquired information, it seems that:

(1) Farms adopting soil conservation and/or mini-irrigation technologies without changing the crops previously raised have enjoyed an increase in real income in the form of more food produced per unit land/effort. Less corn and beans are purchased than before, but farmers seem to feel greater freedom to manage their own affairs than before. Dietary change and nutrition status are probably unchanged, although the health of farmers no longer migrating seasonally has likely improved.

(2) Farmers having previously grown a variety of vegetables in addition to milpa have enjoyed 30-50 percent increases in overall output from hillside terracing alone, significantly more if irrigation is included. Cash incomes have increased comparably, and there is some evidence that these farmers, having already become accustomed to consuming some of their own vegetable output (especially cabbages and carrots), are consuming even more. None of these farmers volunteered the information that they were buying more food, however. Dietary patterns have probably not changed, but the overall volume consumed per capita within the households has probably increased.

(3) Farmers having previously raised traditional crops who subsequently diversified on terraced and/or irrigated land experienced the greatest gains in per capita cash incomes. There is no direct evidence that these farmers are consuming more or differently than before,





but it is this group which seems to have the best probability of dietary change and nutritional gain as the "permanent income" they foresee rises with time.

#### FUTURE WORK

The three broad generalizations listed above should be taken as hypotheses only. They represent no more than impressions gained after a hectic three-week tour of selected project sites. Substantially more work needs to be done to verify or to refute them with statistical rigor, and I submit that such work should be incorporated into all future evaluation studies of comparable projects. In general, there is a need to get a better grip than we now have on what determines the demand side of the food equation in countries like Guatemala. Only thus will we be able to make sensible judgements about how much to program for supply-increasing development projects; only thus will we be able to incorporate sensible consumption/nutrition goals into development programs and--the reverse side of the coin--estimate the impact of malnutrition upon economic efficiency; only thus will we learn what really makes peasant families "tick" in a radically changing environment.

Looking at the matter from a broad perspective, I see two kinds of hypothetical outcomes relating development policies, programs, and projects to consumption and nutrition status. On the one hand, both traditional and the "new" household economics have assumed, on the basis of utility and profit maximization, that most people, farmers included,



would rather have more to consume than less and consequently that they would, in the words of Adam Smith, "buy cheap and sell dear" subject to the limits of competition.

Thus, the standard static conclusions: More income = more consumption; lower relative prices of consumer goods = more consumption; more efficient methods of production = lower costs = higher net incomes = higher consumption. And so on.

I think most people eventually wind up behaving this way, once they have been exposed to the marketplace long enough to be comfortable with it and to covet the benefits it offers.

On the other hand, low income farmers who have endured low incomes and the accompanying risk and uncertainty for a long time may be reluctant to change "tried and true" ways quickly. We don't really live in a static world, after all, and what counts most in economic development is change, hopefully in the "right" directions. Like conservative investors who have been burned in the past by unreliable stocks or severe market recessions, the small farmer of Guatemala seems to react cautiously to change (our "permanent income" hypothesis). Assuming that the rural development projects we have been discussing continue to affect incomes favorably, it is likely that more and more farmers will behave more and more like our "traditional" image of them: buying more food, delving more boldly into new technologies, evolving more complex intrafamily relationships, responding more promptly as both producers and consumers to changing relative prices, and--in the very long run--evolving into specialized producers and generalized consumers.



All this suggests that, following any truly effective integrated rural development project such as we have seen in Guatemala, there will be a period of transition during which farm households may not seem to be behaving according to the predictions of orthodox consumption/production theory.

Those of us who are economists and who have worked in developing countries have encountered this phenomenon at one time or another, and we are learning to expect it. Decision-makers and politicians, however, are usually in a hurry. Rarely do bureaucratic and political time horizons exceed four or five years. Yet the transition we have been discussing may require every bit of that time--and probably longer--to work itself out. Post-project evaluations undertaken during the transition period may well turn up results both perplexing and discouraging to policy-makers who lack an appreciation for the time needed for large numbers of poor people to gain the needed confidence to act like the theoreticians say they ought to act, given better technology and higher incomes.

In the future, then, it will be important to estimate the nature, duration, and impact of "development transition periods" when devising evaluation strategies for large scale development projects.

#### ADDITIONAL HYPOTHESES

Here is a list of some testable hypotheses relating to possible results of projects like the ones we have been discussing:

- (1) HYPOTHESIS: Changes in dietary patterns and/or in the volume





of foods consumed by terracing farm households will originate from own-production (i.e., the "farm effect") and probably from increased milk and eggs in the diet and a broadening of the range of vegetables consumed.

(2) HYPOTHESIS: As cash incomes on diversifying and non-diversifying farms rise and persist, farmers will overcome traditional eating habits by consuming more out of an increasingly varied home production and out of purchases from other farmers ("market effect").

(3) HYPOTHESIS: Even those farmers who, having terraced and/or irrigated without diversifying, will be better-off nutritionally for no longer having to migrate seasonally for additional income to buy food (e.g., less illness due to miasmic plantation climates, less time lost in transit, greater return to work on own-farms vs. absurdly low wages earned on plantations, etc.).

(4) HYPOTHESIS: In the absence of direct extension services, farmers having terraced and/or irrigated fields will spontaneously experiment with nontraditional crops and with nontraditional diet items from their own production; in other words, "spread effects" will be strong.

(5) HYPOTHESIS: Small farmers, nevertheless, are acutely aware of price trends in their localities and in nearby communities, and experimentation with new crops will be influenced by price expectations.

(6) HYPOTHESIS: Improvements in market access roads will accelerate farmers adopting new crops and dietary patterns via (a) gains in incomes where transport costs have been a constraint, and (b) more frequent visits to markets and greater exposure to a broader range of purchaseable foods.



(7) HYPOTHESIS: As farmers begin buying more food rather than consuming out of their own stored production, "savings" in the form of stored production will diminish in proportion to rising sales, rising money incomes, rising purchases, and rising money savings. What to do with extra cash is a novel question for small, formerly poor, farmers, but it may be a real one, if savings institutions are not created apace with agronomic and socio-economic gains.

(8) HYPOTHESIS: Farmers diversifying crops on gravity-irrigated land will be more likely to switch from production to purchases of corn and beans than their counterparts participating in pure soil conservation programs or in pump system irrigation projects.



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